

WHAT IS CLAIMED IS:

1. An echo canceling system provided in a full-duplex communication system, the system comprising:
 - 5 an arrival time detecting portion for detecting a respective echo arrival time of one or plural echo paths based on a reference signal and an echo signal;
 - a pseudo-echo calculating filter for calculating as many pseudo-echo signals as the detected arrival times;
 - 10 an adding unit for overlapping the calculated pseudo-echo signals to obtain an overall pseudo-echo signal; and
 - a subtracting unit for subtracting the overall pseudo-echo signal from the echo signal.
- 15 2. The echo canceling system according to claim 1, wherein the arrival time detecting portion calculates a correlation coefficient between the reference signal and the echo signal and detects a time difference as the arrival time in a case where the correlation coefficient is larger than a predetermined threshold.
- 20 3. An echo canceling system provided in a full-duplex communication system, the system comprising:
 - a window multiplication / orthogonal transformation processing portion for performing an orthogonal transformation processing represented
 - 25 by a fast Fourier transform for a predetermined window length based on a reference signal and an echo signal to obtain an amplitude spectrum and a phase spectrum of each of the reference signal and the echo signal;
 - an arrival time detecting portion for detecting one or plural echo arrival times based on the amplitude spectrum of the reference signal and
 - 30 the amplitude spectrum of the echo signal;
 - a pseudo-echo calculating filter for calculating as many amplitude

spectra of pseudo-echo signals as the detected arrival times;

an adding unit for overlapping the calculated amplitude spectra of the pseudo-echo signals to obtain an amplitude spectrum of an overall pseudo-echo signal;

5 a subtracting unit for subtracting the amplitude spectrum of the overall pseudo-echo signal from the amplitude spectrum of the echo signal to obtain an amplitude spectrum of an echo canceling signal; and

an inverse orthogonal transformation / overlap processing portion for performing an inverse orthogonal transformation processing based on
10 the amplitude spectrum of the echo canceling signal and the phase spectrum of the echo signal, followed by an overlap processing, to obtain an echo canceled signal.

4. The echo canceling system according to claim 3, wherein the arrival
15 time detecting portion calculates a correlation coefficient between the amplitude spectrum of the reference signal and the amplitude spectrum of the echo signal and detects a number of frames as the arrival time in a case where the correlation coefficient is larger than a predetermined threshold.

20 5. An echo canceling method to be applied to a full-duplex communication system, the method comprising:

detecting a respective echo arrival time of one or plural echo paths based on a reference signal and an echo signal;

calculating as many pseudo-echo signals as the detected arrival
25 times;

overlapping the calculated pseudo-echo signals to obtain an overall pseudo-echo signal; and

subtracting the overall pseudo-echo signal from the echo signal.

30 6. An echo canceling method to be applied to a full-duplex communication system, the method comprising:

performing an orthogonal transformation processing represented by

a fast Fourier transform for a predetermined window length based on a reference signal and an echo signal to obtain an amplitude spectrum and a phase spectrum of each of the reference signal and the echo signal;

5 detecting echo arrival times of one or plural echo paths based on the amplitude spectrum of the reference signal and the amplitude spectrum of the echo signal;

calculating as many amplitude spectra of pseudo-echo signals as the detected arrival times;

10 overlapping the calculated amplitude spectra of the pseudo-echo signals to obtain an amplitude spectrum of an overall pseudo-echo signal;

subtracting the amplitude spectrum of the overall pseudo-echo signal from the amplitude spectrum of the echo signal to obtain an amplitude spectrum of an echo canceling signal; and

15 performing an inverse orthogonal transformation processing based on the amplitude spectrum of the echo canceling signal and the phase spectrum of the echo signal, followed by an overlap processing, to obtain an echo canceled signal.

7. A recording medium storing a computer-executable program for realizing an echo canceling method to be applied to a full-duplex communication system, the program comprising

20 detecting a respective echo arrival time of one or plural echo paths based on a reference signal and an echo signal;

25 calculating as many pseudo-echo signals as the detected arrival times;

overlapping the calculated pseudo-echo signals to obtain an overall pseudo-echo signal; and

subtracting the overall pseudo-echo signal from the echo signal.

30 8. A recording medium storing a computer-executable program for realizing an echo canceling method to be applied to a full-duplex communication system, the program comprising

- performing an orthogonal transformation processing represented by a fast Fourier transform for a predetermined window length based on a reference signal and an echo signal to obtain an amplitude spectrum and a phase spectrum of each of the reference signal and the echo signal;
- 5 detecting echo arrival times of one or plural echo paths based on the amplitude spectrum of the reference signal and the amplitude spectrum of the echo signal;
- calculating as many amplitude spectra of pseudo-echo signals as the detected arrival times;
- 10 overlapping the calculated amplitude spectra of the pseudo-echo signals to obtain an amplitude spectrum of an overall pseudo-echo signal;
- subtracting the amplitude spectrum of the overall pseudo-echo signal from the amplitude spectrum of the echo signal to obtain an amplitude spectrum of an echo canceling signal; and
- 15 performing an inverse orthogonal transformation processing based on the amplitude spectrum of the echo canceling signal and the phase spectrum of the echo signal, followed by an overlap processing, to obtain an echo canceled signal.

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